C16 cont'd

relatively moving said mask and a substrate with respect to said illumination beam, respectively, to perform scanning exposure of said substrate with said illumination beam through said mask.

C17

80. (Twice Amended) A device manufacturing method comprising a step of transferring a device pattern onto a work piece, wherein said transferring step comprises:

illuminating a slit area on a predetermined plane on which a mask is arranged with an illumination beam emerging from a fly-eye type integrator having a plurality of optical elements each of which has a cross sectional shape substantially equal to a shape of said slit area on said predetermined plane; and

relatively moving said mask and said work piece with respect to said illumination beam, respectively, to perform scanning exposure of said work piece with said illumination beam through said mask.

REMARKS

Claims 1-104 are pending. By this Amendment, claims 43, 54, 64, 76-78 and 80 are amended. No new matter is added by the above amendments.

The above amendments should be entered after final rejection at least because they do not raise any new issues or the issue of new matter. The amendments further clarify that the "predetermined plane" containing the rectangular or slit area that is illuminated by the illumination optical system is the plane on which the mask is arranged. This feature was previously clearly-and-explicitly recited in many claims (see, e.g., claims 76-78 and 80), and thus is not a new issue or new matter. Entry of the amendments is solicited.

I. Description of Claim Amendments

The first clauses of claims 43, 54 and 64 are amended: (1) to insert "on which a mask is arranged" after "predetermined plane" at line 3; and (2) to insert "on said predetermined plane" after "rectangular area" (claim 43, line 6) or after "slit area" (claim 54, lines 6-7;

claim 64, lines 4-5). The second clauses of claims 43, 54 and 64 are amended: (1) to change "a mask" to "said mask" (in the first line of the second clause of each claim); and (2) to insert "on said predetermined plane" after "rectangular area" (claim 43, second line of second clause) or after "slit area" (claims 54 and 64, second line of second clause in each claim). Claims 76-78 and 80 are amended to insert "on said predetermined plane" after "area" at the end of the first clause of each claim.

II. Supplemental Reissue Declaration

A Supplemental Reissue Declaration will be filed shortly that addresses the amendments made to the claims in this Amendment.

III. Surrender of Original Letters Patent

Applicants are prepared to surrender the original Letters Patent once this application is deemed to be in condition for allowance. The Examiner is invited to contact Applicants' undersigned attorney at the telephone number listed below once the Examiner agrees that this application is in condition for allowance, and then Applicants' undersigned attorney can surrender the original Letters Patent.

IV. All Claims are in Condition for Allowance

Applicants note with appreciation the allowance of claims 1-42 and 84-104. Applicants also note with appreciation the indication of allowable subject matter in claims 49-53, 58-63 and 69-75. Applicants respectfully submit that all pending claims are in condition for allowance for at least the reasons set forth below.

Claims 43-48, 54-57, 64-68 and 76-83 stand rejected under 35 U.S.C. §103(a) over JP-A-02-48627 (JP-627) in view of U.S. Patent No. 5,194,893 to Nishi, and vice versa. These rejections are respectfully traversed. In particular, the combination of JP-627 and Nishi does not disclose or suggest the combination of features recited in the rejected claims.

Nishi discloses a scanning exposure apparatus that includes a fly-eye lens 7, and that uses a blind mechanism (see, e.g., Fig. 7 of Nishi) to illuminate a slit area on a mask. Nishi does not disclose or suggest any relationship between: (1) the shape of the fly-eye lens exit plane and the shape of the mask illumination area as recited in independent claims 43, 76 and 77; or (2) the shape of the elements of the fly-eye lens 7 and the shape of the illumination area on the mask as recited in independent claims 54, 78 and 80. In addition, Nishi does not disclose or suggest that the fly-eye lens forms a plurality of light source images in which the number of light source images arranged in a first direction corresponding to the longitudinal direction of the slit area (formed on the mask) is different from the number of light source images arranged in a second direction that crosses the first direction as recited in independent claims 64, 81 and 83.

Applicants agree with the Office Action that JP-627 discloses an internal reflection type optical integrator with a square shape. In addition, as noted in the translated portion of JP-627 that was submitted with Applicants' December 21, 2001 Information Disclosure Statement, JP-627 discloses that the cross-sectional shape of the rods that make up the optical integrator can be square or have other shapes. For example, JP-627 states "any shape whose bottom [cross-sectional] surface can be densely arranged in a plane, such as an equilateral triangle or a hexagon, is also acceptable."

JP-627 does not, however, disclose or suggest making the shape of the exit plane of the optical integrator or the shape of the elements of the optical integrator have "a shape substantially equal to that" of the area that is illuminated on the mask. Rather, JP-627 discloses that the exit plane is square and that the shape of the elements making up the optical integrator can vary, as long as those shapes can be "densely arranged in a plane." In addition, while the Examiner is correct in stating that a "square is simply a [sic] one type of rectangle," using the square-shaped optical integrator of JP-627 in the scanning exposure apparatus of

Nishi would not result in what is claimed in the rejected claims of this application because the square-shaped optical integrator of JP-627 is not the same shape as the slit-shaped illumination area formed by the blind mechanism illustrated in Fig. 7 of Nishi. Moreover, since JP-627 does not disclose or suggest making the shape of the optical integrator or its elements the same as the shape of the area that is illuminated on the mask, there is no teaching or suggestion to modify the shape of the JP-627 optical integrator or its elements to have the shape of the mask-illumination area of Nishi.

Thus, regardless of whether one interprets "rectangular" to include or exclude a square, combining Nishi and JP-627 does not result in what is recited in independent claims 43, 54, 76-78 and 80 because the resulting optical integrator will not have an exit plane or optical elements having a shape substantially equal to the shape of the illumination area that is formed on the mask.

In particular, regarding independent claims 43, 76 and 77, there is no teaching or suggestion from Nishi and JP-627 to provide an illumination optical system that illuminates a rectangular area on a predetermined plane on which a mask is arranged, and which includes an internal reflection type integrator with an exit plane having a shape substantially equal to that of the rectangular area on the predetermined plane. In particular, the optical illuminator of JP-627 has a square exit plane, whereas the mask-illumination area of Nishi is not square. Neither reference discloses or suggests making the optical integrator exit plane have a shape that is substantially the same as the shape of the mask-illumination area. The claimed relationship improves the illumination uniformity and efficiency. See, for example, col. 15, lines 14-24, col. 15, lines 32-37 and col. 15, lines 44-58 of U.S. Patent No. 5,636,003 (the patent that forms the basis of the present reissue application).

Similarly, with respect to independent claims 54, 78 and 80, Nishi combined with JP-627 does not disclose or suggest an illumination optical system that illuminates a slit area

on a predetermined plane on which a mask is arranged, and that includes a fly-eye type integrator having a plurality of optical elements, each of which has a cross-sectional shape that is substantially equal to the slit area on the predetermined plane. Neither reference discloses any relationship between the shape of the optical elements forming a fly-eye type integrator and the shape of the area that is illuminated on a mask.

Regarding independent claims 64, 81 and 83, neither Nishi nor JP-627 discloses or suggests an illumination optical system that forms a plurality of light source images in which the number of light source images arranged in a first direction corresponding to a longitudinal direction of the slit area is different from a number of light source images arranged in a second direction crossing the first direction. The Office Action refers to Fig. 4 of JP-627. However, Fig. 4 is merely used to explain the function of an inner reflection type integrator. Fig. 5 of JP-627 shows the plurality of light source images that are formed by the integrator of JP-627. As is clear from Fig. 5, the number of light source images in the lateral direction is the same as the number of light source images arranged along the longitudinal direction. Thus, Nishi and JP-627 do not disclose or suggest the features recited in independent claims 64, 81 and 83.

Accordingly, Applicants request that the rejections of claims 43-48, 54-57, 64-68 and 76-83 over JP-627 and Nishi be withdrawn.

Claims 43-48, 54-57 and 76-80 stand rejected under 35 U.S.C. §103(a) over JP-A-01-311502 (JP-502) in view of Nishi. This rejection is respectfully traversed.

JP-502 discloses a structure in which the shape of each minute lens 17a of a fly-eye lens 17 is set in accordance with the shape of an object to be illuminated. That is, the shape of the minute lenses 17a is made to have a shape similar to a shape of a film F2, which is the object to be illuminated. As discussed above, Nishi discloses a fly-eye lens forming a

plurality of secondary light source images in a scanning exposure apparatus in which a slit area is illuminated on a mask.

Neither JP-502 nor Nishi when combined discloses or suggests the provision of an internal reflection type integrator having an exit plane with a shape substantially equal to that of a rectangular illumination area formed on a predetermined plane on which a mask is arranged as recited in independent claims 43, 76 and 77. In addition, JP-502 and Nishi when combined do not disclose or suggest the provision of a fly-eye type integrator having a plurality of optical elements, each of which has a cross-sectional shape that is substantially equal to a slit area that is illuminated on a predetermined plane on which the mask is arranged as recited in independent claims 54, 78 and 80.

Accordingly, Applicants request that the rejection of claims 43-48, 54-57 and 76-80 over JP-502 and Nishi be withdrawn.

Claims 43-48, 54-57 and 76-80 stand rejected under 35 U.S.C. §103(a) over JP-A-01-259533 (JP-533) in view of Nishi.[1] This rejection is respectfully traversed.

As noted in the Office Action, JP-533 merely discloses a square optical integrator that is made from a plurality (9) of square optical elements arranged in a 3X3 matrix. See Fig. 4 of JP-533. Accordingly, similar to what was discussed above with respect to JP-627, combining JP-533 with Nishi would merely result in a square optical integrator formed from square optical elements in a scanning exposure apparatus that forms a not-square illumination area on a mask.

Thus, the combination of JP-533 and Nishi does not result in an internal reflection type integrator with an exit plane having a shape substantially equal to the rectangular area that is formed on a predetermined plane on which a mask is arranged as recited in

[1] Although the Office Action refers to JP-A-01-259333, it is believed that the Office Action is referring to JP-A-01-259533.

independent claims 43, 76 and 77. In addition, the combination of JP-533 and Nishi does not result in an illumination optical system having a fly-eye type integrator made from a plurality of optical elements, each of which has a cross-sectional shape that is substantially equal to the slit area that is illuminated on a predetermined plane on which a mask is arranged as recited in independent claims 54, 78 and 80.

Accordingly, Applicants respectfully request that the rejection of claims 43-48, 54-57 and 76-80 over JP-533 and Nishi be withdrawn.

V. Conclusion

In view of the foregoing, Applicants respectfully submit that this application is in condition for allowance. Favorable consideration and prompt allowance earnestly solicited.

Should the Examiner believe anything further would be desirable to place this application in even better condition for allowance, the Examiner is invited to contact Applicants' undersigned attorney at the telephone number listed below.

Respectfully submitted,

Mario A. Costantino
Registration No. 33,565

MAC/ccs

Attachment:
Petition for Extension of Time

Date: February 19, 2003

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